

NBS REPORT

7676

A BIBLIOGRAPHY OF THERMOPHYSICAL PROPERTIES
FOR FLUORINE FROM 0° TO 300°K

by

L. A. Hall and R. D. McCarty



UNPUBLISHED PRELIMINARY DATA

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
BOULDER LABORATORIES
Boulder, Colorado

GPO PRICE \$ _____
OTS PRICE(S) \$ _____
Hard copy (HC) \$1.00
Microfiche (MF) \$0.50

FACILITY FORM 602

N65 17316
(ACCESSION NUMBER)
24
(PAGES)
27-50285
(NBSA CR OR TMX OR AD NUMBER)
33
(CATEGORY)
1
(THRU)

THE NATIONAL BUREAU OF STANDARDS

Functions

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1950, Public Law 619. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to government agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. Research projects are also performed for other government agencies when the work relates to and supplements the basic program of the Bureau or when the Bureau's unique competence is required. The scope of activities is suggested by the listing of divisions and sections on the inside of the back cover.

Publications

The results of the Bureau's research are published either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau publishes three periodicals available from the Government Printing Office: The Journal of Research, published in four separate sections, presents complete scientific and technical papers; the Technical News Bulletin presents summary and preliminary reports on work in progress; and the Central Radio Propagation Laboratory Ionospheric Predictions provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: Monographs, Applied Mathematics Series, Handbooks, Miscellaneous Publications, and Technical Notes.

A complete listing of the Bureau's publications can be found in National Bureau of Standards Circular 460, National Bureau of Standards, 1901 to June 1947 (\$1.25), and the Supplement to National Bureau of Standards Circular 460, July 1947 to June 1957 (\$1.50), and Miscellaneous Publication 440, July 1957 to June 1960 (includes Titles of Papers Published in Official Publications 1955 to 1959) (\$2.25); available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT

81.40-40-81450

April 1, 1963

NBS REPORT

7676

A BIBLIOGRAPHY OF THERMOPHYSICAL PROPERTIES
FOR FLUORINE FROM 0° TO 300°K

by

L. A. Hall and R. D. McCarty




2

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
BOULDER LABORATORIES
Boulder, Colorado

NASA CR-50, 285

IMPORTANT NOTICE

NATIONAL BUREAU OF STANDARDS REPORTS are usually preliminary or progress accounting documents intended for use within the Government. Before material in the reports is formally published it is subjected to additional evaluation and review. For this reason, the publication, reprinting, reproduction, or open-literature listing of this Report, either in whole or in part, is not authorized unless permission is obtained in writing from the Office of the Director, National Bureau of Standards, Washington 25, D. C. Such permission is not needed, however, by the Government agency for which the Report has been specifically prepared if that agency wishes to reproduce additional copies for its own use.



CONTENTS

	Page
Abstract	1
Introduction	1
Abstracting Journals and Bibliographies Searched	1
Format for Listing Citation and Document Contents	2
Index of Properties	3
Bibliography of References	6

A BIBLIOGRAPHY OF THERMOPHYSICAL PROPERTIES
FOR FLUORINE FROM 0° TO 300°K

by L. A. Hall and R. D. McCarty

Abstract

13395

This bibliography of thermophysical properties for fluorine from 0° to 300°K presents 51 citations which include author, title, reference, properties studied, temperature and pressure ranges, state of substance, type of data presented (i.e., whether the data are derived from experimental measurements, theoretical considerations or as a compilation from other sources), the form and amount of data. An index according to property, sub-indexed for state of substance, is included.

1. Introduction

This bibliography of the thermophysical properties of fluorine from 0° to 300°K is a result of a thorough search of the world's scientific literature. The initial search of indices of abstracting journals and other publications led to the procurement of pertinent articles and the ultimate search of their bibliographies and references for other pertinent material. We have listed references for company reports as well as references for articles published in journals.

2. Abstracting Journals and Bibliographies Searched

The initial search for references of articles containing information for fluorine at low temperatures included a review of the following:

1. Subject Index to Unclassified ASTIA Documents, Vol. 3, Numbers AD 1 to AD 75 000,
2. Technical Abstract Bulletin Cumulative Index, Annual Index, 1960,
3. List of Publications Issued by the Bureau of Mines from July 1, 1910 to January 1, 1960,
4. Chemical Abstracts, Vol. 24 to 55, 1930 to 1962,
5. Thermophysical Properties Research Center Retrieval Guide, Y.S. Touloukian, McGraw-Hill Book Company, Inc., New York (1960),
6. Cryogenic Data Center Storage and Retrieval System Search, R.G. Smith, National Bureau of Standards, Boulder, Colorado (1962),
7. Bibliographies and references cited in each document listed in this bibliography.

3. Format for Listing Citation and Document Contents

The citations have been arranged alphabetically by first author and numbered. Only information from the article which concerns thermo-physical properties of fluorine is noted. The information given in each citation includes:

1. Author(s),
2. Title (original language) and translated title, if original is in a language other than English,
3. Reference (If the same article is published in more than one place, both references are cited.),
4. Chemical Abstract number or ASTIA number, when they are known,
5. Properties studied for fluorine, state of substance, temperature and pressure ranges when appropriate,
6. Substances, other than fluorine, which are discussed in the article (Where no fluids are listed, the contents of the document are restricted to properties of fluorine only.),
7. Designation as to primary intent of article,
 - a. experimental,
 - b. theoretical,
 - c. compilation*,
 - d. reference book†(For typical examples of the four types of articles, turn to bibliography numbers 6, 8, 19, and 46.)
8. Form in which data is reported,
 - a. tabular - tables (number of values),
 - b. graphical,
 - c. equations,
9. Apparatus, if described or illustrated,
10. Original language, if other than English.

The bibliography is cross-indexed according to property with sub-indexes for the state of the substance, i.e., solid, liquid, or vapor.

* In compilations, the bibliography number of the original article from which the data was obtained is listed.

† The amount of data in reference books is not given.

4. Index of Properties

1. Density (specific gravity)
2. Vapor Pressure
3. Heat Capacity (specific heat)
4. Enthalpy, Entropy, Gibbs Function
5. Viscosity
6. Surface Tension
7. Thermal Conductivity
8. Diffusion Coefficients
9. Equation of State, Virial Coefficients
10. Dielectric Constants
11. Index of Refraction
12. Triple Point
13. Boiling Point (normal)
14. Melting Point (normal)
15. Critical Point
16. Phase Transition Heats, Latent Heats

Property Index

<u>1. Density (specific gravity)</u>		
1, 2, 5, 10, 11, 16, 17, 21, 22, 23, 29, 32, 33, 34, 41, 46, 49		
Liquid:	Vapor:	
1, 2, 5, 10, 11, 16, 17, 21, 22, 23, 29, 34, 49	16, 32, 33, 41, 46	
<u>2. Vapor Pressure</u>		
1, 2, 3, 5, 6, 7, 19, 20, 23, 41		
Solid:	Liquid:	
3, 5	1, 2, 3, 5, 6, 7, 20, 23, 41	
<u>3. Heat Capacity (specific heat)</u>		
1, 2, 5, 8, 9, 12, 16, 20, 23, 27, 30, 32, 35, 39, 41, 43, 51		
Solid:	Liquid:	Vapor:
1, 2, 5, 20, 23, 27, 32, 35	1, 2, 5, 20, 23, 27, 35	23, 39, 41, 43, 51
<u>4. Enthalpy, Entropy, Gibbs Function</u> (see also Phase Transition Heats, Latent Heats)		
1, 2, 8, 9, 12, 16, 20, 27, 30, 35, 39, 41, 43, 45, 51		
Solid:	Liquid:	Vapor:
1, 2, 19, 20	1, 2, 16, 19, 20, 27	16, 17, 19, 35, 39, 41, 43, 51
<u>5. Viscosity</u>		
1, 2, 4, 11, 15, 18, 23, 24, 31, 32, 36, 40, 44, 47, 48, 51		
Liquid:	Vapor:	
1, 2, 11, 23, 31	4, 15, 18, 23, 24, 31, 32, 36, 40, 44, 47, 48, 51	
<u>6. Surface Tension</u>		
1, 2, 11, 23, 25, 32, 49		
<u>7. Thermal Conductivity</u>		
4, 14, 23, 31, 32, 42, 44, 50, 51		
Liquid:	Vapor:	
42	4, 14, 23, 31, 32, 42, 44, 50, 51	

<u>8. Diffusion Coefficients</u> 4
<u>9. Equation of State, Virial Coefficients</u> 48, 51
<u>10. Dielectric Constants</u> 5, 13, 23, 26
<u>11. Index of Refraction</u> 13, 51
<u>12. Triple Point</u> 43
<u>13. Boiling Point (normal)</u> 1, 2, 3, 5, 6, 7, 11, 17, 32, 34, 37, 39, 43, 46
<u>14. Melting Point (normal)</u> 1, 2, 5, 17, 19, 20, 27, 32, 34, 38, 39, 43, 46
<u>15. Critical Point</u> 1, 2, 5, 6, 19, 32, 43
<u>16. Phase Transition Heats, Latent Heats</u> 1, 2, 3, 5, 6, 7, 17, 19, 20, 23, 27, 29, 32, 39, 41, 43, 46

5. Bibliography of References (Listed Alphabetically by First Author)

- 1 AEROJET-GENERAL CORPORATION
DESIGN HANDBOOK FOR LIQUID FLUORINE GROUND HANDLING EQUIPMENT
AEROJET-GENERAL CORP., SCARAMENTO, CALIF., WRIGHT AIR DEVELOPMENT
DIVISION TECH. REPT. 60-159 (1960)

DENSITY (SATURATED LIQUID) (65 TO 102 DEGREES K), VAPOR PRESSURE (53 TO 89 DEGREES K), HEAT CAPACITY (P=CONSTANT), ENTHALPY, ENTROPY GIBBS FUNCTION (SATURATED LIQUID AND SOLIDS I AND II) (15 TO 85 DEGREES K), VISCOSITY (SATURATED LIQUID) (69 TO 83 DEGREES K), SURFACE TENSION (66 TO 80 DEGREES K), BOILING, MELTING AND TRANSITION POINTS, CRITICAL TEMPERATURE AND PRESSURE, HEATS OF VAPORIZATION AND FUSION
COMPILATION - DATA FROM 6, 7, 8, 11, 20, 22, 25, 27, 29, 35, 49, 51

- 2 ALLIED CHEMICAL
FLUORINE
ALLIED CHEMICAL, GENERAL CHEMICAL DIV., NEW YORK, N.Y., PRODUCT DATA
SHEET PD-TA-85413 (1958) 21 P

DENSITY (SATURATED LIQUID) (65 TO 85 DEGREES K), VAPOR PRESSURE (53 TO 90 DEGREES K), SURFACE TENSION (66 TO 81 DEGREES K), VISCOSITY (SATURATED LIQUID) (69 TO 85 DEGREES K), HEAT CAPACITY (P=CONSTANT), ENTROPY, ENTHALPY, GIBBS FUNCTION (SATURATED LIQUID AND SOLIDS I AND II) (15 TO 85 DEGREES K), HEAT CAPACITY (P=CONSTANT), ENTROPY, ENTHALPY, GIBBS FUNCTION (IDEAL GAS PROPERTIES) (100 TO 5000 DEGREES K), CRITICAL TEMPERATURE AND PRESSURE, HEATS OF TRANSITION, FUSION, AND VAPORIZATION, MELTING AND BOILING POINTS
COMPILATION - DATA FROM 8, 11, 20, 49

- 3 AOYAMA, S. AND KANDA, E.
STUDIES ON FLUORINE AT LOW TEMPERATURES II. VAPOUR PRESSURE OF FLUORINE
BULL. J. CHEM. SOC. JAPAN VOL.12, NO. 9, 416-9 (1937)

VAPOR PRESSURE (SATURATED LIQUID) (59 TO 86 DEGREES K), VAPOR PRESSURE (SATURATED SOLID) (51 TO 55 DEGREES K), BOILING POINT, HEAT OF VAPORIZATION
EXPERIMENTAL - TABLES (20 VALUES), EQUATIONS
APPARATUS

- 4 BROKAW, R.S.
ALIGNMENT CHARTS FOR TRANSPORT PROPERTIES, VISCOSITY, THERMAL CONDUCTIVITY AND DIFFUSION COEFFICIENTS FOR NONPOLAR GASES AND GAS MIXTURES AT LOW DENSITIES
LEWIS RESEARCH CENTER, CLEVELAND, OHIO, NATL. AERONAUT. SPACE ADMIN. TECH. REPT. NO. R-81 (1960) 33 P
ASTIA AD 243 198

VISCOSITY, THERMAL CONDUCTIVITY, DIFFUSION COEFFICIENT (VAPOR) (44 TO 22400 DEGREES K)
FLUORINE AND 51 OTHER GASES
THEORETICAL - EQUATIONS, NOMOGRAPHS

- 5 CADY, G.H. AND BURGER, L.L.
PHYSICAL PROPERTIES OF FLUORINE
P. 315-18 IN FLUORINE CHEMISTRY, ACADEMIC PRESS INC., NEW YORK

DENSITY (SATURATED LIQUID), DIELECTRIC CONSTANT (57 TO 83 DEGREES K)
VAPOR PRESSURE OF SOLID AND LIQUID (NO TEMPERATURE RANGE GIVEN),
HEAT CAPACITY (P=CONSTANT) (14 TO 85 DEGREES K), HEAT CAPACITY
(V=CONSTANT) (17 TO 20 DEGREES K), MELTING AND BOILING POINTS,
CRITICAL TEMPERATURE AND PRESSURE, HEATS OF FUSION AND VAPORIZATION,
FLUORINE, CHLORINE, ARGON, OXYGEN, NITROGEN
COMPILATION - DATA FROM 3, 6, 24, 25, 26, 27

- 6 CADY, G.H. AND HILDEBRAND, J.H.
THE VAPOR PRESSURE AND CRITICAL TEMPERATURE OF FLUORINE
J. AM. CHEM. SOC. VOL.52, 3839-43 (1930)

VAPOR PRESSURE (72 TO 86 DEGREES K), HEAT OF VAPORIZATION, BOILING
POINT, CRITICAL TEMPERATURE
EXPERIMENTAL - TABLES (45 VALUES), GRAPH, EQUATION
APPARATUS

- 7 CLAUSSEN, W.H.
THE VAPOR PRESSURE OF FLUORINE
J. AM. CHEM. SOC. VOL.56, 614-5 (1934)
C.A. 28, 2233 4

VAPOR PRESSURE (6 TO 75 CM HG), BOILING POINT, HEAT OF VAPORIZATION
EXPERIMENTAL - EQUATION (NO TABULAR VALUES GIVEN)
APPARATUS

- 8 COLE, L.G., FARBER, M. AND ELVERUM, G.W.
THERMODYNAMIC PROPERTIES OF THE FLUORINE ATOM AND MOLECULE AND OF
HYDROGEN FLUORIDE TO 5000 DEGREES K
J. CHEM. PHYS. VOL.20, NO. 4, 586-9 (1952)
C.A. 46, 10838 G

IDEAL GAS PROPERTIES - HEAT CAPACITY (P=CONSTANT), ENTROPY, ENTHALPY,
GIBBS FUNCTION (100 TO 5000 DEGREES K)
FLUORINE, FLUORINE ATOM, HYDROGEN FLUORIDE
THEORETICAL - EQUATIONS, TABLES (200 VALUES)

- 9 DOUGLAS, T.B. AND BECKETT, C.W.
PRELIMINARY REPORT ON THE THERMODYNAMIC PROPERTIES OF SELECTED LIGHT-
ELEMENT COMPOUNDS (UNPUBLISHED REPORT)

IDEAL GAS PROPERTIES - ENTHALPY, ENTROPY, HEAT CAPACITY (P=CONSTANT),
GIBBS FUNCTION (50 TO 7000 DEGREES K)
FLUORINE AND 45 OTHER GASES
THEORETICAL - TABLES (400 VALUES)

- 10 DRUGMAN, J. AND RAMSAY, W.
CXVII. SPECIFIC GRAVITIES OF THE HALOGENS AT THEIR BOILING POINTS
AND OF OXYGEN AND NITROGEN
J. CHEM. SOC. VOL.77, 1228-33 (1900)

DENSITY (SATURATED LIQUID) (AT THE NORMAL BOILING POINT)
FLUORINE, CHLORINE, IODINE, OXYGEN AND NITROGEN
EXPERIMENTAL
APPARATUS

- 11 ELVERUM, G.W. AND DOESCHER, R.N.
PHYSICAL PROPERTIES OF LIQUID FLUORINE
J. CHEM. PHYS. VOL.20, NO.12, 1834-6 (1952)
ALSO
JET PROPULSION LAB., CALIF. INST. OF TECH., PASADENA, PROGRESS REPT.
NO. 20-174 (MAY 1952) 8 P
ASTIA AD 3789

VISCOSITY (SATURATED LIQUID) (69 TO 83 DEGREES K), DENSITY (SATURATED
LIQUID) (65 TO 85 DEGREES K)
SURFACE TENSION (69 TO 81 DEGREES K), BOILING POINT
EXPERIMENTAL - TABLES (25 VALUES), EQUATION, GRAPHS
APPARATUS

- 12 EVANS, W.H., MUNSON, T.R. AND WAGMAN, D.D.
THERMODYNAMIC PROPERTIES OF SOME GASEOUS HALOGEN COMPOUNDS
J. RESEARCH NATL. BUR. STANDARDS VOL.55, 147-64 (1955) RP 2614
C.A. 50, 11796

IDEAL GAS PROPERTIES - GIBBS FUNCTION, ENTHALPY, ENTROPY, HEAT CAPACITY
(P=CONSTANT) (250 TO 3000 DEGREES K)
FLUORINE, IODINE, BROMINE, CHLORINE AND 15 HALOGEN COMPOUNDS
THEORETICAL - EQUATIONS, TABLE (240 VALUES)

- 13 FRANCK, E.U.
EINE NEUBESTIMMUNG DER BRECHZAHL GASFORMIGEN FLUORS
A NEW DETERMINATION FOR REFRACTION OF GASEOUS FLUORINE
NATURWISSENSCHAFTEN VOL.41, 37 (1954)
C.A. 48, 10397

DIELECTRIC CONSTANT (AT THE NORMAL BOILING POINT), INDEX OF
REFRACTION (273 DEGREES K AND 1 ATM.)
FLUORINE, OXYGEN, NITROGEN, CHLORINE, HYDROGEN, ARGON
EXPERIMENTAL
GERMAN

- 14 FRANCK, E.U.
ZUR TEMPERATURABHANGIGKEIT DER WARMELEITFAHIGKEIT EINIGER GASE
TEMPERATURE DEPENDENCE OF THE THERMAL CONDUCTIVITY OF SEVERAL GASES
Z. ELEKTROCHEM. VOL.55, 636-43 (1951)
C.A. 46, 4296 A
- THERMAL CONDUCTIVITY (VAPOR) (93 TO 787 DEGREES K AND 70 TO 350 MM HG)
FLUORINE, ARGON, AIR, NITROGEN, OXYGEN AND 6 OTHER GASES
EXPERIMENTAL - TABLE (15 VALUES)
GERMAN
- 15 FRANCK, E.U. AND STOBER, W.
ZAHIGKEIT UND MOLEKULARER WIRKUNGSDURCHMESSER DES FLUORS
THE VISCOSITY AND EFFECTIVE MOLECULAR DIAMETER OF FLUORINE
Z.NATURFORSCH. VOL. 7A, 822-3 (1952)
C.A. 47, 4155 D
- VISCOSITY (VAPOR) (90 TO 471 DEGREES K AND 1 ATM.), MOLECULAR DIAMETER
FLUORINE, ARGON, NITROGEN, OXYGEN, CHLORINE
EXPERIMENTAL - TABLE (7 VALUES), GRAPH
GERMAN
- 16 FRICKE, E.F.
PART 8. COOLING EQUIPMENT, DESIGN STUDY. THE THERMODYNAMICS OF OXYGEN
HYDRAZINE AND FLUORINE
REPUBLIC AVIATION CORPORATION, FARMINGDALE, L.I., NEW YORK,
REPORT NO. F-5028-101 (1948) 120 P
ASTIA ATI 121 150
- IDEAL AND REAL GAS PROPERTIES - ENTHALPY, ENTROPY, HEAT CAPACITY
(P=CONSTANT) (85 TO 300 DEGREES K AND 1 ATM.), AND ENTHALPY, ENTROPY,
DENSITY (SATURATED LIQUID AND VAPOR) (85 TO 144 DEGREES K AND 1 TO
55 ATM.)
FLUORINE, OXYGEN, HYDRAZINE
THEORETICAL - EQUATIONS, TABLES (6000 VALUES), T-H CHART
- 17 GORDON, S. AND WILKINS, R.L.
THEORETICAL MAXIMUM PERFORMANCE OF LIQUID FLUORINE-LIQUID OXYGEN
MIXTURES WITH JP-4 FUEL AS ROCKET PROPELLANTS
NATL. ADVISORY COMM. AERONAUT. RESEARCH MEMO. NO. RM E54 H09 (1954)
18 P
- DENSITY (LIQUID) (77 DEGREES K), BOILING AND FREEZING POINTS, HEATS
OF FUSION AND VAPORIZATION, SPECIFIC IMPULSE
FLUORINE, OXYGEN
COMPILATION - DATA FROM 29, 39

- 18 HIRSCHFELDER, J.O., BIRD, R.B. AND SPOTZ, E.L.
THE TRANSPORT PROPERTIES OF GASES AND GASEOUS MIXTURES. II.
CHEM. REV. VOL.44, 205-31 (1949)

VISCOSITY (VAPOR) (50 TO 300 DEGREES K)
FLUORINE AND 20 OTHER GASES
THEORETICAL - EQUATIONS

- 19 HONIG, R.E. AND HOOR, H.O.
VAPOR PRESSURE DATA FOR SOME COMMON GASES
RCA REV. VOL.21, 360-8 (SEPT 1960)
C.A. 55, 5066 H

VAPOR PRESSURE (54 TO 89 DEGREES K), TRANSITION, MELTING AND BOILING
POINTS, HEATS OF TRANSITION, FUSION AND VAPORIZATION
FLUORINE AND 20 OTHER GASES
COMPILATION - DATA FROM 20, 44

- 20 HU, J-H., WHITE, D. AND JOHNSTON, H.L.
CONDENSED GAS CALORIMETRY. V. HEAT CAPACITIES, LATENT HEATS AND
ENTROPIES OF FLUORINE FROM 13 TO 85 DEGREES K, HEATS OF TRANSITION,
FUSION, VAPORIZATION AND VAPOR PRESSURES OF THE LIQUID
J. AM. CHEM. SOC. VOL.75, 5642-5 (1953)
C.A. 48, 1792 B

ALSO

OHIO STATE UNIV., RESEARCH FOUNDATION, COLUMBUS, CRYOGENIC LAB.,
(APR 1953) 11 P
ASTIA AD 10 067

HEAT CAPACITY (P=CONSTANT) (SATURATED LIQUID AND SOLIDS I AND II)
(13 TO 81 DEGREES K), ENTROPY, ENTHALPY, GIBBS FUNCTION (SATURATED
LIQUID AND SOLIDS I AND II) (15 TO 85 DEGREES K), VAPOR PRESSURE (53
TO 89 DEGREES K), MELTING POINT, HEATS OF FUSION, VAPORIZATION, AND
TRANSITION
EXPERIMENTAL - TABLES (120 VALUES)
APPARATUS

- 21 JARRY, R.L.
STUDIES OF THE PROPERTIES OF LIQUID FLUORINE, NITROGEN TRIFLUORIDE
AND PERCHLORYL FLUORIDE
PENN. SALT MFG. CO., WYNDMOOR, PA., REPT. NO. AFOSR-TR-56-50 (DEC 1956)
ASTIA AD 110 311

DENSITY (SATURATED LIQUID) (67 TO 103 DEGREES K)
FLUORINE, NITROGEN TRIFLUORIDE, PERCHLORYL FLUORIDE
EXPERIMENTAL - EQUATIONS, TABLE (1 VALUE)
(THIS ARTICLE CONTAINS THE SAME DATA FOR FLUORINE AS BIBLIOGRAPHY
NO. 22)

- 22 JARRY, R.L. AND MILLER, H.C.
THE DENSITY OF LIQUID FLUORINE BETWEEN 67 AND 103 DEGREES K
J. AM. CHEM. SOC. VOL.78, 1552-3 (1956)
C.A. 50, 10470

DENSITY (SATURATED LIQUID) (67 TO 103 DEGREES K)
EXPERIMENTAL - TABLES (10 VALUES), EQUATION
APPARATUS

- 23 JOHNSON, V.J. (EDITOR)
A COMPENDIUM OF THE PROPERTIES OF MATERIALS AT LOW TEMPERATURE
(PHASE I). PART I. PROPERTIES OF FLUIDS, PART III. BIBLIOGRAPHY
OF REFERENCES (CROSS INDEXED)
WRIGHT AIR DEVELOPMENT DIVISION TECH. REPT. 60-56 (1960) 560 P
(NATIONAL BUREAU OF STANDARDS, CRYOGENIC ENGINEERING LABORATORY,
BOULDER, COLORADO)

DENSITY (SATURATED LIQUID) (65 TO 103 DEGREES K), THERMAL CONDUCTIVITY
(VAPOR) (100 TO 350 DEGREES K), SPECIFIC HEAT (P=CONSTANT) (SATURATED
SOLID AND LIQUID) (VAPOR) (14 TO 300 DEGREES K AND 1 ATM.), VAPOR
PRESSURE, DIELECTRIC CONSTANT (85 DEGREES K), SURFACE TENSION (70 TO
90 DEGREES K), VISCOSITY (LIQUID) (70 TO 83 DEGREES K) AND VISCOSITY
(VAPOR) (90 TO 327 DEGREES K)
REFERENCE BOOK

- 24 KANDA, E.
STUDIES ON FLUORINE AT LOW TEMPERATURES. V. VISCOSITY OF FLUORINE
GAS AT LOW TEMPERATURES
BULL. CHEM. SOC. JAPAN VOL.12, 463-8 (1937)

VISCOSITY (VAPOR) (86 TO 273 DEGREES K AND 1 ATM), MOLECULAR DIAMETER
FLUORINE, HYDROGEN
EXPERIMENTAL - TABLE (10 VALUES), EQUATIONS, GRAPH
APPARATUS

- 25 KANDA, E.
STUDIES ON FLUORINE AT LOW TEMPERATURES. VI. SURFACE TENSION OF LIQUID
FLUORINE
BULL. CHEM. SOC. JAPAN VOL.12, 469-72 (1937)
C.A. 32, 847 7

ALSO

J. CHEM. SOC. (JAPAN) VOL.58, 810-2 (1937)

SURFACE TENSION (57 TO 85 DEGREES K AND 28 TO 733 MM HG)
FLUORINE, OXYGEN
EXPERIMENTAL - TABLE (10 VALUES), EQUATIONS, GRAPH
APPARATUS

- 26 KANDA, E.
STUDIES ON FLUORINE AT LOW TEMPERATURES. VII. DETERMINATION OF
DIELECTRIC CONSTANTS OF CONDENSED GASES
BULL. CHEM. SOC. JAPAN VOL.12, 473-9 (1937)
C.A. 32, 4842

DIELECTRIC CONSTANT, DENSITY (SATURATED LIQUID) (57 TO 83 DEGREES K)
FLUORINE, OXYGEN, CHLORINE, HYDROGEN CHLORIDE
EXPERIMENTAL - TABLE (8 VALUES), GRAPH
APPARATUS
- 27 KANDA, E.
STUDIES ON FLUORINE AT LOW TEMPERATURES. VIII. DETERMINATION OF
MOLECULAR HEAT, HEAT OF FUSION OF CONDENSED FLUORINE AND ENTROPY OF
FLUORINE
BULL. CHEM. SOC. JAPAN VOL.12, 511-20 (1937)

HEAT CAPACITY (P=CONSTANT) (14 TO 85 DEGREES K AT SATURATION PRESSURE)
HEAT CAPACITY (V=CONSTANT) (14 TO 20 DEGREES K AT SATURATION PRESSURE)
HEAT OF FUSION, MELTING AND TRANSITION POINTS, ENTROPY (85 DEGREES K)
FLUORINE, OXYGEN
EXPERIMENTAL - TABLE (20 VALUES), GRAPH
THEORETICAL - EQUATIONS
APPARATUS
- 28 KELLEY, K.K.
CONTRIBUTIONS TO THE DATA ON THEORETICAL METALLURGY. III. THE FREE
ENERGIES OF VAPORIZATION AND VAPOR PRESSURE OF INORGANIC SUBSTANCES
U.S. BUREAU OF MINES BULL. NO. 383 (1935) 132 P

HEAT OF VAPORIZATION AND FREE ENERGY OF VAPORIZATION
FLUORINE, HELIUM, OXYGEN, METHANE, ARGON, CARBON MONOXIDE, NITROGEN,
HYDROGEN, AND SEVERAL METALS
THEORETICAL - EQUATIONS
- 29 KILNER, S.B., RANDOLPH, C.L. AND GILLESPIE, R.W.
THE DENSITY OF LIQUID FLUORINE
J. AM. CHEM. SOC. VOL.74, 1086-7 (1952)

DENSITY (SATURATED LIQUID) (77 DEGREES K)
EXPERIMENTAL - 1 TABULAR VALUE
APPARATUS

- 30 KOLSKY, H.G.
THE THERMODYNAMIC PROPERTIES OF 54 ELEMENTS CONSIDERED AS IDEAL
MONATOMIC GASES
UNIVERSITY OF CALIFORNIA, LOS ALAMOS SCIENTIFIC LAB., LOS ALAMOS,
NEW MEXICO, REPT. NO. LA 2110 (1957) 138 P

IDEAL GAS PROPERTIES - ENTHALPY, HEAT CAPACITY (P=CONSTANT), ENTROPY,
GIBBS FUNCTION (10 TO 8000 DEGREES K)
FLUORINE AND 53 OTHER ELEMENTS
THEORETICAL - EQUATIONS, TABLE (560 VALUES)
- 31 LILEY, P.E.
SURVEY OF RECENT WORK ON THE VISCOSITY, THERMAL CONDUCTIVITY AND
DIFFUSION OF GASES AND LIQUEFIED GASES BELOW 500 DEGREES K
PURDUE UNIV., THERMOPHYSICAL PROPERTIES RESEARCH CENTER REPT. NO. 13
(JUNE 1961) 33 P

THERMAL CONDUCTIVITY (VAPOR), VISCOSITY (LIQUID AND VAPOR)
(50 TO 500 DEGREES K)
FLUORINE, AIR, HYDROGEN, HELIUM AND 20 OTHER GASES
BIBLIOGRAPHY
- 32 MATHESON COMPANY, INC.
MATHESON GAS DATA BOOK
THE MATHESON COMPANY, INC., EAST RUTHERFORD, NEW JERSEY (1961) 420 P

DENSITY (85 TO 273 DEGREES K AND 1 ATM.), HEAT CAPACITY (P=CONSTANT
AND V=CONSTANT) (20 DEGREES K), SURFACE TENSION (81 DEGREES K), THERMAL
CONDUCTIVITY, VISCOSITY (273 DEGREES K AND 1 ATM.), CRITICAL TEMPERA-
TURE AND PRESSURE, MELTING AND BOILING POINTS, HEATS OF VAPORIZATION
AND FUSION
FLUORINE AND 90 OTHER GASES
COMPILATION - DATA FROM 8, 11, 49, 51
- 33 MOISSAN, H.
NOUVELLES RECHERCHES SUR LA DENSITE DU FLUOR
NEW RESEARCHES INTO THE DENSITY OF FLUORINE
COMPT. REND. VOL.138, 728-32 (1904)

DENSITY (273 DEGREES K AND 1 ATM)
FLUORINE
EXPERIMENTAL - 1 VALUE
THEORETICAL - EQUATION
FRENCH

- 34 MOISSAN, H. AND DEWAR, J.
NOUVELLES EXPERIENCES SUR LA LIQUEFACTION DU FLUOR
NEW EXPERIMENTS ON THE LIQUEFACTION OF FLUORINE
COMPT. REND. VOL.125, 505-11 (1897)

BOILING AND MELTING POINT, DENSITY (LIQUID) (73 DEGREES K)
FLUORINE, OXYGEN
EXPERIMENTAL - TABLE (3 VALUES)
FRENCH
- 35 MURPHY, G.M. AND RUBIN, E.
THE ENTROPY OF FLUORINE
J. CHEM. PHYS. VOL.20, 1179-80 (1952)

ENTROPY (298.16 DEGREES K), HEAT CAPACITY (P=CONSTANT) (SATURATED
SOLID AND LIQUID) (15 TO 85 DEGREES K)
THEORETICAL - EQUATION
- 36 ORLICEK, A.F.
GRAPHISCHE UMRECHNUNGSBILDER (NOMOGRAMM NR. 26) DIE DYNAMISCHE
VISKOSITAT VON GASEN
THE DYNAMIC VISCOSITY OF GASES (NOMOGRAM NO. 26)
MITT. CHEM. FORSCHUNGS. INST. WIRTSCH. OSTERR. VOL.8, 150-1 (1954)

VISCOSITY (VAPOR) (173 TO 1273 DEGREES K AND 1 ATM.)
FLUORINE AND 34 OTHER GASES
THEORETICAL - EQUATIONS
GERMAN
- 37 POPOVICI, S. AND POP, M.
SUR LE POINT D'EBULLITION ET LES FORCES INTERMOLECULAIRES
THE BOILING POINT AND INTERMOLECULAR FORCES
COMPT. REND. VOL.244, 195-8 (1957)
C.A. VOL.51, 7084 F

BOILING POINT (NORMAL), INTERMOLECULAR FORCES
FLUORINE, HELIUM, NEON, HYDROGEN, OXYGEN
THEORETICAL - GRAPH
FRENCH
- 38 POPOVICI, S. AND POP, M.
SUR LE POINT DE FUSION ET LES FORCES INTERMOLECULAIRES
ON THE MELTING POINT AND INTERMOLECULAR FORCES
COMPT. REND. VOL.246, 2609-11 (1958)
C.A. 52, 15154 G

MELTING POINT (NORMAL) AND INTERMOLECULAR FORCES
FLUORINE AND 14 OTHER SUBSTANCES
THEORETICAL - GRAPH
FRENCH

- 39 ROSSINI, F.D., WAGMAN, D.D., EVANS, W.H., LEVINE, S. AND JAFFE, I.
SELECTED VALUES OF CHEMICAL THERMODYNAMIC PROPERTIES
NATL. BUR. STANDARDS (U.S.) CIRC. 500 (1952), REPRINTED IN 1961 IN TWO
PARTS AND AVAILABLE FROM U.S. GOVT. PRINTING OFFICE, WASHINGTON 25,
D.C., PART 1, CATALOG NO. C 13.4.500/PT.1, PART 2, CATALOG NO.
C 13.4.500/PT.2

SPECIFIC HEAT (P=CONST.), ENTROPY (298 DEGREES K), MELTING AND
BOILING POINTS, PHASE TRANSITION HEATS
REFERENCE BOOK

- 40 RUDGE, A.J. AND SOUTHAM, P.H.
THE VISCOSITY OF GASEOUS FLUORINE - CRITICAL LITERATURE SURVEY
IMPERICAL CHEMICAL IND. LTD., GEN. CHEM. GROUP-RESEARCH DEPT.,
WIDNES LAB., WIDNES (1943) 9 P

VISCOSITY (VAPOR) (86 TO 273 DEGREES K)
THEORETICAL - EQUATIONS

- 41 SALTZMAN, B.E.
GENERALIZED THERMODYNAMIC PROPERTIES OF DIATOMIC AND TRIATOMIC GASES
IND. ENG. CHEM. VOL.50, 1593-8 (1958)

HEAT CAPACITY (P=CONSTANT) (VAPOR) (111 TO 3333 DEGREES K),
COMPRESSIBILITY (VAPOR) (86 TO 288 DEGREES K AND 0.5 TO 260 ATM.),
ENTHALPY, ENTROPY (VAPOR) (100 TO 2944 DEGREES K), VAPOR PRESSURE
(SATURATED LIQUID), HEAT OF VAPORIZATION
FLUORINE AND 22 OTHER GASES
THEORETICAL - EQUATIONS, NOMOGRAM, GRAPHS

- 42 SCHAEFER, C.A. AND THODOS, G.
THERMAL CONDUCTIVITY OF DIATOMIC GASES. LIQUID AND GASEOUS STATES
A. I. CH. E. JOURNAL VOL.5, NO.3, 367-72 (1959)

THERMAL CONDUCTIVITY (LIQUID AND VAPOR) (42 TO 11000 DEGREES K AND
0 TO 5500 ATM.), THEORY OF CORRESPONDING STATES
FLUORINE AND 11 OTHER GASES
THEORETICAL - GRAPHS
CORRELATION

- 43 STULL, D.R. AND SINKE, G.C.
THERMODYNAMIC PROPERTIES OF THE ELEMENTS, ADVANCES IN CHEMISTRY SERIES
NO. 18
AMERICAN CHEMICAL SOCIETY, WASHINGTON (1956) 234 P
- IDEAL MONATOMIC AND DIATOMIC GAS PROPERTIES - HEAT CAPACITY
(P=CONSTANT), ENTHALPY, ENTROPY, GIBBS FUNCTION (298 TO 3000 DEGREES K
BOILING AND MELTING POINTS, TRIPLE POINT, CRITICAL TEMPERATURE AND
PRESSURE, HEATS OF MELTING AND VAPORIZATION
FLUORINE AND 91 OTHER ELEMENTS
REFERENCE BOOK
- 44 THERMOPHYSICAL PROPERTIES RESEARCH CENTER
DATA BOOK, VOL.2, NONMETALLIC ELEMENTS AND THEIR COMPOUNDS (GASEOUS
AND LIQUID STATES)
PURDUE UNIV., LAFAYETTE, INDIANA, SCHOOL OF MECHANICAL ENGINEERING
(1961) 150 P
- THERMAL CONDUCTIVITY (VAPOR) (88 TO 810 DEGREES K), VISCOSITY (VAPOR)
(88 TO 337 DEGREES K)
FLUORINE AND 39 OTHER ELEMENTS AND COMPOUNDS
CORRELATION - REFERENCE BOOK
- 45 THOMAS, L.H.
AN ADDITIVE FUNCTION OF ENTROPY OF BOILING AND THE PREDICTION OF
LATENT HEAT OF VAPORIZATION AND VAPOUR PRESSURE OF LIQUIDS
J. CHEM. SOC. VOL.161, 2132-52 (1959)
C.A. 53, 14622
- ENTROPY OF BOILING
FLUORINE, OXYGEN, NITROGEN, CARBON MONOXIDE, METHANE AND 30 OTHER
COMPOUNDS
THEORETICAL - EQUATIONS
- 46 WASHBURN, E.W. (EDITOR)
INTERNATIONAL CRITICAL TABLES OF NUMERICAL DATA, PHYSICS, CHEMISTRY,
AND TECHNOLOGY, VOL. 1
MC GRAW-HILL BOOK CO. INC., NEW YORK (1926)
- DENSITY (273 DEGREES K AND 1 ATM.), BOILING AND MELTING POINTS, HEATS
OF FUSION AND VAPORIZATION
REFERENCE BOOK
- 47 WHALLEY, E. AND SCHNEIDER, W.G.
THE LENNARD-JONES 12.6 POTENTIAL AND THE VISCOSITY OF GASES
J. CHEM. PHYS. VOL.20, 657-61 (1952)
- VISCOSITY (VAPOR) (120 TO 250 DEGREES K)
FLUORINE AND 7 OTHER GASES
THEORETICAL - EQUATIONS

- 8 WHITE, D., HU, J-H. AND JOHNSTON, H.L.
THE INTERMOLECULAR FORCE CONSTANTS OF FLUORINE
J. CHEM. PHYS. VOL.21, NO.7, 1149-52 (1953)

SECOND VIRIAL COEFFICIENTS, VISCOSITY (VAPOR) (85 TO 280 DEGREES K),
INTERMOLECULAR FORCE CONSTANTS
FLUORINE, NITROGEN AND OXYGEN
EXPERIMENTAL - TABLE (10 VALUES), GRAPH, EQUATIONS
APPARATUS

- 49 WHITE, D., HU, J-H. AND JOHNSTON, H.L.
THE DENSITY AND SURFACE TENSION OF LIQUID FLUORINE BETWEEN 66 AND
80 DEGREES K
J. AM. CHEM. SOC. VOL.76, 2584-6 (1954)

ALSO

OHIO STATE UNIVERSITY RESEARCH FOUNDATION, COLUMBUS, CRYOGENIC
LABORATORY (FEB 1953) 7 P
ASTIA AD 5786

DENSITY (SATURATED LIQUID), SURFACE TENSION (66 TO 79 DEGREES K)
EXPERIMENTAL - TABLES (15 VALUES), GRAPHS, EQUATIONS
APPARATUS

- 50 WICKE, E.
THE DISSOCIATION ENERGY OF FLUORINE
J. PHYS. CHEM. VOL.56, 358-60 (1952)
C.A. 46, 6920 E

THERMAL CONDUCTIVITY (VAPOR) (90 TO 800 DEGREES K AND 1 ATM.),
DISSOCIATION ENERGY
FLUORINE, IODINE, FLUORINE COMPOUNDS
EXPERIMENTAL - GRAPHS, EQUATIONS
APPARATUS

- 51 WICKE, E. AND FRANCK, E.U.
PHYSIKALISCH-CHEMISCHE EIGENSCHAFTEN DES FLUORS
PHYSICAL-CHEMICAL PROPERTIES OF FLUORINE
ANGEW. CHEM. VOL.66, 701-10 (1954)
C.A. 49, 2133 H

THERMAL CONDUCTIVITY (VAPOR) (100 TO 1000 DEGREES K), SECOND VIRIAL
COEFFICIENT (VAPOR) (80 TO 300 DEGREES K), SPECIFIC HEAT (VAPOR)
(P=CONSTANT), ENTHALPY, ENTROPY (100 TO 2000 DEGREES K), VISCOSITY
(VAPOR) (100 TO 500 DEGREES K), INDEX OF REFRACTION
FLUORINE, OXYGEN, NITROGEN, CHLORINE, BROMINE
REVIEW - TABLES (50 VALUES), GRAPHS
GERMAN